



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Minoru Hashimoto et al.

APPLICATION No. : 10/642,758

Group Art Unit : 2655

FILING DATE : August 19, 2003

Examiner : G. Patel

TITLE : OPTICAL DISC DRIVE AND OPTICAL PICKUP APPARATUS THAT
CORRECT ASTIGMATISM (As Amended)

Hon. Commissioner of Patents and Trademarks,
Washington, D.C. 20231

SIR:

CERTIFIED TRANSLATION

I, Takashi Narita, am an official translator of the Japanese language into the English language and I hereby certify that the attached comprises an accurate translation into English of Japanese Application No. H11-047422, filed on February 25, 1999.

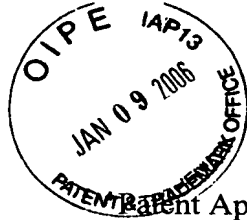
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

December 28, 2005

Date

Takashi Narita

Takashi Narita



[Document Name] Patent Application

[Reference Number] 9900004901

[Filing Date] February 25, 1999

[To] Hon. Commissioner, Patent Office

[IPC] G11B 7/00

[Name of Invention] Optical Disc Drive

[Number of Claims] 4

[Inventor]

[Address] c/o Sony Corporation

7-35, Kitashinagawa 6-chome, Shinagawa-ku, Tokyo, Japan

[Name] Minoru Hashimoto

[Inventor]

[Address] c/o Sony Corporation

7-35, Kitashinagawa 6-chome, Shinagawa-ku, Tokyo, Japan

[Name] Tomohiko Baba

[Patent Applicant]

[Identification Number] 000002185

[Name] Sony Corporation

[Representative] Nobuyuki Idei

[Patent Attorney]

[Identification Number] 100102185

[Patent Attorney]

[Name] Shigenori Tada

[Telephone Number] 03-5950-1478

[Indication of Charge]

[Number of Prepaid Ledger] 047267

[Amount] 21,000 yen

[List of Document]

[Document]	Specification	1
[Document]	Drawing	1
[Document]	Summary	1
[General Power of Attorney Number]		9600452
[Need of Proof]	Yes	

[Name of Document] SPEFICAITION

[Title of the Invention]

Optical Disc Drive

[Claims]

[Claim1]

An optical disc drive adapted to read information from an optical disc by emitting a laser beam from a selected one of a plurality of light sources and irradiating the laser beam to the optical disc by an optical system common to the plurality of light sources, detecting a return component of the laser beam irradiated to the optical disc and processing the result of return light detection, wherein:

the light sources are disposed being separated from each other radially of the optical disc; and

all or part of the optical system is moved radially of the optical disc in response to the laser beam emitted from the selected one of the light sources.

[Claim 2]

The optical disc drive according to Claim 1, wherein:

the optical system uses an objective lens to focus the laser beam on an information recording surface of the optical disc;

tracking is controlled by moving the objective lens radially of the optical disc correspondingly to the result of return light detection; and

the part of the optical system is the objective lens.

[Claim 3]

The optical disc drive according to Claim 1, wherein the plurality of light sources and a light-receiving element for the return light are formed integrally with each other.

[Claim 4]

The optical disc drive according to Claim 1, wherein the optical system is moved away from the light source selected to emit a laser beam.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to an optical disc drive, and more particularly to an optical disc drive adapted to play a compact and digital versatile disc (DVD). According to the present invention, to emit a laser beam from a selected one of a plurality of light sources disposed apart from each other radially of such an optical disc and focus it on an optical disc through a common optical system, the optical system is moved radially of the optical disc correspondingly to the selection of the light source for emitting the laser beam and thus a single optical pickup can be used in common with such a plurality of optical discs without any deterioration of the optical property.

[0002]

[Prior Art]

The conventional optical disc drive or CD player is adapted to irradiate a laser beam from an optical pickup onto an information recording surface of a CD and process a detection result of return light from the CD surface to read or reproduce a variety of data recorded in the CD .

[0003]

The conventional optical pickups include a type having a light-emitting element and light-receiving element disposed separately therein, and a type using

an optical integrated device consisting integrally of the light-emitting and -receiving elements. The latter type of optical pickup can be designed more compact and have a higher reliability than the former type.

[0004]

[Problems to Be Solved by the Invention]

It is considered that using such an optical integrated device to build the optical pickup also in an optical disc drive for DVD, a so-called DVD player, for example, the DVD player can be designed compact and simple. A DVD player will be very conveniently usable if it can also read data from a CD.

[0005]

In this case, by forming an optical integrated device integrally from a light-emitting element and light-receiving element for DVD and a light-emitting element and light-receiving element for CD, an optical disc player capable of writing data to both CD and DVD will be possible.

[0006]

However, in case the optical integrated device is constructed as above, a light-emitting element for DVD or compact disc is to be disposed off the optical axis of the objective lens. The laser beam emitted from the light-emitting element thus disposed off the optical axis will be incident obliquely to the objective lens. In this case, the aberration will increase and optical property be deteriorated in the optical system for the laser beam.

[0007]

It is therefore an object of the present invention to provide an optical disc drive in which a single optical pickup can be used with one of a plurality of light-emitting elements selected for one of a plurality of optical discs without deterioration of the optical property.

[0008]

[Means to Solve the Problem]

To overcome the above-mentioned drawbacks, all or part of an optical system is moved radially of an optical disc in response to the selection of one of a plurality of light sources for emitting a laser beam as set forth in claim 1.

[0009]

As set forth in claim 1, all or part of the optical system is moved radially of the optical disc in response to the selection of one of the plurality of light sources for emitting a laser beam to correct a deviation, if any, of any of light-emitting elements from the optical axis of an objective lens and thus prevent deterioration of optical property.

[0010]

[Preferred Embodiment of the Invention]

The present invention will be described in detail below concerning the embodiment thereof with appropriate reference to the accompanying drawings.

[0011]

(1) Overall construction of the embodiment

FIG. 1 schematically illustrates a tracking control system of the optical disc drive as an embodiment of the present invention. The optical disc drive generally indicated with a reference 1 reads data recorded in a DVD as an optical disc 2A, and also data recorded in a compact disc as an optical disc 2B.

[0012]

Note that the compact disc 2B is an optical disc from which recorded data can be read by processing return light resulted from irradiation of a laser beam to an information recording surface of the disc through a transparent substrate of 1.2 mm in thickness. On the other hand, the DVD 2A is an optical disc from which recorded data can be read by processing return light resulted from irradiation of a laser beam to an information recording surface of the disc through a transparent substrate of 0.6 mm in thickness.

[0013]

In this optical disc drive 1, an optical pickup 3 is disposed to be movable radially of the optical disc by a predetermined sled mechanism. A laser beam emitted from an optical integrated device 4 is irradiated to the optical disc 2A or 2B through a collimator lens 5, aperture 6 and objective lens 7, while return light from the optical disc 2A or 2B is incident upon the optical integrated device 4 through the objective lens 7, aperture 6, and collimator lens 5.

[0014]

The optical disc drive 1 processes a result of the detection of the return light by the optical integrated device 4 to produce a tracking error signal, focus error signal and a read signal. The optical disc drive 1 moves the objective lens 7 based on the tracking and focus error signals to control the tracking and focus, and processes the read signal to reproduce data recorded in the optical disc 2A or 2B.

[0015]

The optical integrated device 4 is formed from a light-emitting element and light-receiving element for CD and a light -emitting element and light-receiving element for DVD, both integrally disposed in one package. The optical integrated device 4 has two semiconductor laser diode chips forming the light-emitting elements, respectively, disposed about 100 μm apart from each other radially of the optical disc 2A or 2B. These semiconductor laser diode chips are selectively driven under the control of a system controller (not show) depending upon which is currently used, the optical disc 2A or 2B. Thus, the optical integrated device 4 selectively emits a laser beam of a wavelength corresponding to the optical disc 2A or 2B towards the optical disc 2A or 2B, and return light from the optical disc 2A or 2B is detected by a corresponding light-receiving element.

[0016]

The collimator lens 5 converts the laser beam emitted from the optical integrated device 4 into a nearly parallel beam. Note that the collimator lens 5 is so disposed in relation to the optical integrated device 4 that the optical axis thereof

aligns with that of the DVD laser beam. Thus, the collimator lens 5 has the optical axis thereof not aligned with the optical axis of the CD laser beam.

[0017]

As shown in FIG. 2, the aperture 6 is a transparent plate with a dielectric layer evaporated thereon and a circular opening formed in the center thereof. Namely, the aperture 6 has the dielectric layer around the central opening formed therein. The dielectric layer serves as a filter to selectively intercept a laser beam of 780 nm in wavelength for CD while allowing a laser light of 650 nm in wavelength for DVD to penetrate through it. Thus, the aperture 6 will shape the incident laser beam for CD to be a beam having a diameter depending upon the diameter of the opening, while allowing the laser beam for DVD to pass through the aperture 6 with the shape thereof not changed at all. Note that the aperture 6 is so disposed that the center of the opening formed therein will nearly coincide with the optical axis of the CD laser beam.

[0018]

The objective lens 7 is an aspheric plastic lens formed from a transparent resin by injecting molding. By selecting an appropriate refractive index of the transparent resin and shape of the lens surface, the objective lens 7 is formed to focus the incident parallel laser beam for DVD or CD onto the information recording surface of the optical disc 2A or 2B. Thus, the objective lens 7 is formed as a so-called bifocal lens for both the laser beams for DVD and CD,

respectively.

[0019]

Further, the objective lens 7 is movable by a tracking control actuator 8 composed of a voice-coil motor radially of the optical disc 2A or 2B so that tracking control can be done by driving the actuator 8 correspondingly to a tracking error signal. Also, the objective lens 7 is movable by a similar focus control actuator along the optical axis of the laser beam so that focus control can be done by driving the focus control actuator correspondingly to a focus error signal.

[0020]

When not forced by the tracking control actuator 8, the objective lens 7 thus movable will be positioned for the optical axis thereof to be aligned with that of the DVD laser beam while the optical axis will not be aligned with that of the CD laser beam. When reading the optical disc 2B, the objective lens 7 is moved by the tracking control actuator 8 radially of the optical disc 2B correspondingly to the spacing between the light-emitting elements in the optical integrated device 4, whereby the optical property of the optical system is prevented from being deteriorated when reading the optical disc 2B.

[0021]

The optical disc drive 1 further comprises a matrix calculation circuit 9 as shown in FIG. 1. The matrix calculation circuit 9 provides a matrix calculation of a result of the light detection output from the optical integrated device 4 to produce

a tracking error signal TE whose level varies depending upon the magnitude of a tracking error, focus error signal whose level varies depending upon the magnitude of a focus error, and a read signal whose level varies depending upon the pit train. The matrix calculation circuit 9 produces a tracking error signal, focus error signal and read signal for each of DVD and CD.

[0022]

For the tracking control, the optical disc drive 1 further includes a servo circuit 10 and drive circuit 11. The servo circuit 10 produces a drive signal for use to enable a predetermined level of the tracking error signal TE, and the drive circuit 11 drives the actuator 8 under the drive signal.

[0023]

As shown in FIG. 1, the optical disc drive 1 further comprises a switching circuit 12. For reading the optical disc 2B, the switching circuit 12 will be closed under the control of the system controller to provide a predetermined offset voltage to the drive circuit 11 which in turn will add the offset voltage to a drive signal provided from the servo circuit 10, and thus drive the actuator 8. In this optical disc drive 1, tracking control is made with the objective lens 7 moved radially of the optical disc 2B.

[0024]

(2) Construction of the optical integrated device 4

FIG. 3A is a plan view, from the emitted direction of the laser beam, of the

optical integrated device 4, and FIG. 3B is a sectional view, taken along the direction tangential to the circumference of the optical disc 2A or 2B, of the optical integrated device 4. The optical integrated device 4 is constructed by disposing a prism 14 and semiconductor laser diode chips 15A and 15B on a semiconductor substrate 17 to form an optical system 16, putting the optical system 16 in a package 18 and wiring it, and then sealing the package 18 with a transparent glass 19.

[0025]

The semiconductor laser diode chips 15A and 15B are disposed apart by about 100 μm from each other radially of the optical disc 2A or 2B and emit a laser beam having a wavelength of 650 nm for DVD and a laser beam having a wavelength 780 nm for CD, respectively, towards the prism 14.

[0026]

Note that the prism 14 is an optical element provided to separate the laser beam and return light from each other and it is formed to have a generally rectangular shape having a slope at one lateral side thereof. Thus, a laser beam emitted from the semiconductor laser diode chip 15A or 15B is reflected at the slope of the prism 14 towards the collimator lens 5, and return light having traveled reversely along the optical path of the laser beam and incident upon the prism 14 is guided inwardly of this slope.

[0027]

At the prism 14, the return light incident upon the slope is incident upon the bottom of the prim 14. About 50% of the return light is penetrated through the prism bottom while the remainder is reflected towards the top of the prism 14. The return light incident upon the prism top is reflected nearly 100% there towards the prism bottom and allowed to outgo through the prism bottom.

[0028]

For the above reflection of the return light, the prism 14 has a mirror surface formed by evaporation on the top thereof. Also the prism 14 has a beam splitting surface formed on a portion of the bottom thereof at the slope side (will be referred to as "front side" hereinafter) and a beam splitting surface and light-transmissive surface formed on a portion of the bottom thereof at the side away from the slope (will be referred to as "rear side" hereinafter) so that the ratio in amount between the return light allowed to outgo through the prism bottom at the front-side portion and that allowed to outgo through the prism bottom at the rear-side portion will be nearly 1 : 1. The beam splitting surface and light-transmissive surface are formed by the similar evaporation to that used in forming the mirror surface.

[0029]

The semiconductor substrate 17 has light-incident surfaces 25A and 26A for DVD and light-incident surfaces 25B and 26B for CD formed on portions, respectively, thereof upon which the return portion of the laser beam for DVD and

that of the laser beam for CD are incident from the prism 14.

[0030]

FIG. 4 is a plan view, partially enlarged in scale, of the light detection systems for CD and DVD, respectively, formed from the above-mentioned light-incident surfaces of the optical integrated device 4. For the optical integrated device 4, the directions of the semiconductor laser diode chips 15A and 15B and size of the prism 14 are selected so that when the laser beam is just focused, a beam spot defined on the semiconductor substrate 17 by the return light having passed through the prism 14 will be formed, at the rear-side portion, like a focal line, and at the front-side portion, like an ellipse having the major axis thereof directed perpendicularly to the extension of the focal line at the rear-side portion.

[0031]

The light-incident surfaces 25B and 26B for CD are formed side by side tangentially to the circumference of CD to have a general shape of a rectangle, and each is divided radially of CD by a parting line extending tangentially to the circumference of CD. Thus, when the optical head is just on an intended track on a CD, each of the light-incident surfaces 25B and 26B can detect a beam spot defined thereon and quartered radially of CD. Namely, a result of light detection by each of the quartered light-incident surfaces is provided as output. In FIG. 4, the outer light-incident surface divisions at the front-side portion are indicated with references *m* and *p*, respectively, while the inner ones are indicated with references

n and o , respectively. The outer light-incident surface divisions at the rear-side portion are indicated with references q and t , respectively, while the inner ones are indicated with references r and s , respectively.

[0032]

The light-incident surfaces 25A and 26A for DVD are formed side by side tangentially to the circumference of the optical disc 2A in the similar manner to that for the light-incident surfaces 25B and 26B to have a general shape of a rectangle. The light-incident surface 26A at the rear-side portion is formed similarly to the light-incident surface 26B at the rear-side portion for CD.

[0033]

The light-incident surface 25A at the front-side portion is formed similarly to the light-incident surface 25B at the front-side portion for CD, and further it is divided by two tangentially to the circumference of the optical disc. Thus, the semiconductor substrate 17 can produce a tracking error signal by the so-called differential phase detection (DPD). As shown in FIG. 4, the outer and on-slope light-incident surface divisions for DVD at the front-side portion are indicated with references a and d , respectively, and the inner and under-slope light-incident surface divisions at the front-side portion are indicated with references b and c , respectively. Further, the outer and off-slope light-incident surface divisions at the front-side portion are indicated with references e and h , respectively, and the inner and off-slope light-incident surface divisions at the front-side portion are

indicated with references f and g , respectively. Also, the outer light-incident surface divisions at the rear-side portion are indicated with references i and l , respectively, and the inner light-incident surface divisions at the rear-side portion are indicated with references j and k , respectively.

[0034]

The semiconductor substrate 17 converts the results of light detection from the light-incident surface divisions a to t from current to voltage, then calculates the converted signals and provide the results of calculation to the matrix calculation circuit 9 where the calculated signals will further be calculated to produce a tracking error signal, focus error signal and a read signal.

[0035]

When reading a CD, the results of light detection are processed as follows. Differences in light detection are detected between the inner and outer light-incident surface divisions of each of the front- and rear-side light-incident surfaces 25B and 26B, and then a subtraction between the differences is made between the front- and rear-side light surfaces 25B and 26B to produce a focus error signal expressed by $(m + p + r + s) - (n + o + q + t)$. Differences in light detection are detected between the inner and outer circumferential light-incident surface divisions of each of the front- and rear-side light-incident surfaces 25B and 26B, and then a subtraction between the differences is made between the front- and rear-side light surfaces 25B and 26B to produce a tracking error signal expressed

by $(m + n + s + t) - (o + p + q + r)$. Then all the results of light detection at the front- and rear-side light-incident surfaces 25B and 26B are added together to produce a read signal expressed by $(m + n + o + p + q + r + s + t)$.

[0036]

When reading a DVD, the results of light detection are processed in the same manner as in the above for reading a CD to produce a focus error signal expressed by $(a + b + e + h + j + k) - (b + c + f + g + i + l)$ and a read signal expressed by $(a + b + c + d + e + f + g + h + i + j + k + l)$. On the other hand, for production of the tracking error signal TE for DVD, results of light detection are processed as follows. As shown in FIG. 5, results of light detection from two light-incident surfaces corresponding to the inner and outer circumferences of the optical disc 2A are added together by addition circuits 42A to 42D for each of the groups of light-incident surface divisions defined in the direction of the light-incident surfaces 25A and 26B disposed side by side. Thus quantities of light incident upon the inner and outer circumferential-side light-incident surface divisions are determined for each group. For each of the groups, results of light detection are compared in phase between the groups of the inner and outer circumferential-side light-incident surface divisions by phase comparison circuits 43A and 43B, and then added together by an addition circuit 44 to produce a tracking error signal TE.

[0037]

(3) Operation of the embodiment

In the optical disc drive 1 constructed as having been described in the foregoing with reference to FIG. 1, the optical pickup 3 irradiates a laser beam to the optical disc 2A or 3B and detects return light from the optical disc, and a selected one of the signal processing circuits processes the result of return light detection, thereby reading information from the optical disc 2A or 2B.

[0038]

More particularly, a laser beam is emitted from the optical integrated device 4 of the optical pickup 3 incorporated in the optical disc drive 1, converted to a nearly parallel beam by the collimator lens 5, passed through the aperture 6, and guided to the objective lens 7 which will focus the laser beam on an information recording surface of the optical disc 2A or 2B. Return light resulted from reflection of the laser beam at the information recording surface is passed through the objective lens 7 and incident upon the optical integrated device 4 which provides results of return light detection as outputs.

[0039]

In the optical disc drive 1, the tracking error signal TE is produced by processing the results of return light detection as in the above, and the objective lens 7 is moved by the servo circuit 10 radially of the optical disc 2A or 2B until the tracking error signal TE gets a predetermined signal level. Namely, a tracking control is made. Similarly, a focus error signal is produced, and the objective lens

7 is moved up and down until the focus error signal has a predetermined level.

This is the focus control according to the present invention.

[0040]

When the optical disc (2A or 2B) loaded in the optical disc drive 1 is a DVD (namely, 2A), one of the semiconductor laser diode chips 15A and 15B disposed side by side in the optical integrated device 4 radially of the optical disc 2A or 2B (see FIG. 3), that is, the semiconductor laser diode chip 15A, is selected to emit a laser beam towards the optical disc 2A, and return light from the optical disc 2A is detected by the light-incident surfaces 25A and 26A for DVD via the prism 14.

[0041]

Since the optical pickup 3 is disposed so that the optical axes of the objective lens 7 and collimator lens 5 are generally aligned with that of the DVD laser beam, the optical property can effectively be prevented from being deteriorated.

[0042]

On the contrary, when the optical disc loaded in the optical disc drive 1 is CD (namely, 2B), the semiconductor laser diode chip 15B (see FIG. 3) for the CD is selected to emit a laser beam towards the optical disc 2B, and return light from the optical disc 2B is detected by the light-incident surfaces 25B and 26B for CD via the prism 14.

[0043]

In the optical disc drive 1, the switching circuit 12 is closed, so that an offset voltage is added to the drive signal supplied from the servo circuit 10 for moving the objective lens 7 over a predetermined distance radially of the optical disc 2B (tracking control). Thus, in the optical disc drive 1, the aberration developed during read of the optical disc 2B can be reduced to prevent the optical property from being deteriorated.

[0044]

The deterioration of optical property was actually observed using various signals produced by the matrix calculation circuit 9. As the results of the observation showed that when the objective lens 7 is not moved at all, there took place in the tracking error signal TE a deviation of the S-characteristic from the one for the just tracking. When the collimator lens 5 had a focal distance of 23 mm and a distance of 6.176 mm was provided between the collimator lens 5 and objective lens 7, the deviation of the S-characteristic from the just-tracking one could be prevented by moving the objective lens 7 towards the semiconductor laser diode chip for CD.

[0045]

The moving distance of the objective lens 7 varies in proportion to the ratio between the focal distance of the collimator lens 5 and the distance between the collimator lens 5 and objective lens 7. By increasing the distance between the

collimator lens 5 and objective lens 7 in comparison with the focal distance of the collimator lens 5, the objective lens 7 can be moved away from the semiconductor laser diode chip for CD, so that the deviation of the S-characteristic from the just-tracking one can be prevented. Also, when the focal distance of the collimator lens 5 is set equal to that the distance between the collimator lens 5 and objective lens 7, it is possible to prevent the S-characteristic from deviating from the just-tracking one without the necessity of moving the objective lens 7. In this case, however, the design of the objective lens 7 being a bifocal lens will be complicated.

[0046]

To prevent the deterioration of the optical property by moving the objective lens 7, the semiconductor laser diode chips 15A and 15B are disposed side by side radially of the optical disc 2A or 2B in this embodiment. So the tracking control actuator can be used to easily move the objective lens 7. That is, according to the present invention, the optical pickup 3 may be designed simple for moving the objective lens 7 to prevent the optical property from being deteriorated. The optical pickup 3 may be nearly the same in construction as for a compact disc.

[0047]

Note that the laser beam for CD is focused on the compact disc 2B with the diameter thereof limited and numerical aperture reduced by the aperture 6.

[0048]

The return light resulted from reflection of the laser irradiated to an optical disc is incident upon the light-incident surfaces 25A and 26A for DVD or upon those 25B and 26B for CD (as in FIG. 4), and the results of light detection from the light-incident surfaces 25A and 26B are processed depending upon whether the optical disc being played is 2A or 2B, thereby reading the DVD or CD.

[0049]

(4) Effect of the embodiment

In the above optical disc drive 1, one of the semiconductor laser diode chips 15A and 15B disposed apart from each other radially of the optical disc is selected to emit a laser beam, and focused on the optical disc 2A or 2B through the common optical system (including the elements 5, 6 and 7). At this time, the objective lens 7 forming part of the optical system is moved radially of the optical disc for alignment with the laser beam emitted from the selected light source. Thus, when the single optical pickup 3 is used in common with the plurality of optical discs, it is possible to prevent the optical property from being deteriorated.

[0050]

(5) Other possible embodiments

Note that although it was described in the foregoing that only the objective lens is moved, the present invention is not limited to this embodiment, the entire optical system may be adapted to be movable.

[0051]

In the foregoing, the present invention has been described concerning the embodiment in which light-incident surfaces are formed in the optical system for each of the types of optical discs. However, the present invention is not limited to this embodiment but all or part of the optical system may be constructed for common use with the different types of optical discs.

[0052]

The present invention has been described in the foregoing concerning the embodiment adapted to be compatible with both a CD and DVD. However, the present invention is not limited to this embodiment, but can be adapted to be compatible with both a CD and a recordable compact disc such as CD-R.

[0053]

The present invention has been described concerning the embodiment in which two different types of optical disc are read by the single optical pickup. However, the present invention is not limited to this embodiment, but can be adapted to read more than two types of optical disc.

[0054]

The present invention has been described in the foregoing as to the embodiment in which the optical pickup is constructed from the optical integrated device formed integrally from a light-emitting element and light-receiving element. However, the present invention is not limited to this embodiment, but it can be adapted such that the light-emitting and -receiving elements are disposed

separately from each other.

[0055]

[Effect of the Invention]

As having been described in the foregoing, the optical disc drive according to the present invention is adapted such that when a laser beam is emitted from a selected one of a plurality of light sources disposed apart from each other radially of optical discs and focused on the optical disc via a common optical system, the optical system is moved radially of the optical disc correspondingly to the selected light source, thereby permitting to prevent the optical property from being deteriorated when one optical pickup is used in common with the plurality of optical discs.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of the optical disc drive according to the present invention;

FIG. 2 is a plan view of an aperture of an optical pickup in FIG. 1;

FIG. 3A is a plan view, and FIG. 3B is a sectional view, of the optical integrated device included in the optical pickup in FIG. 2;

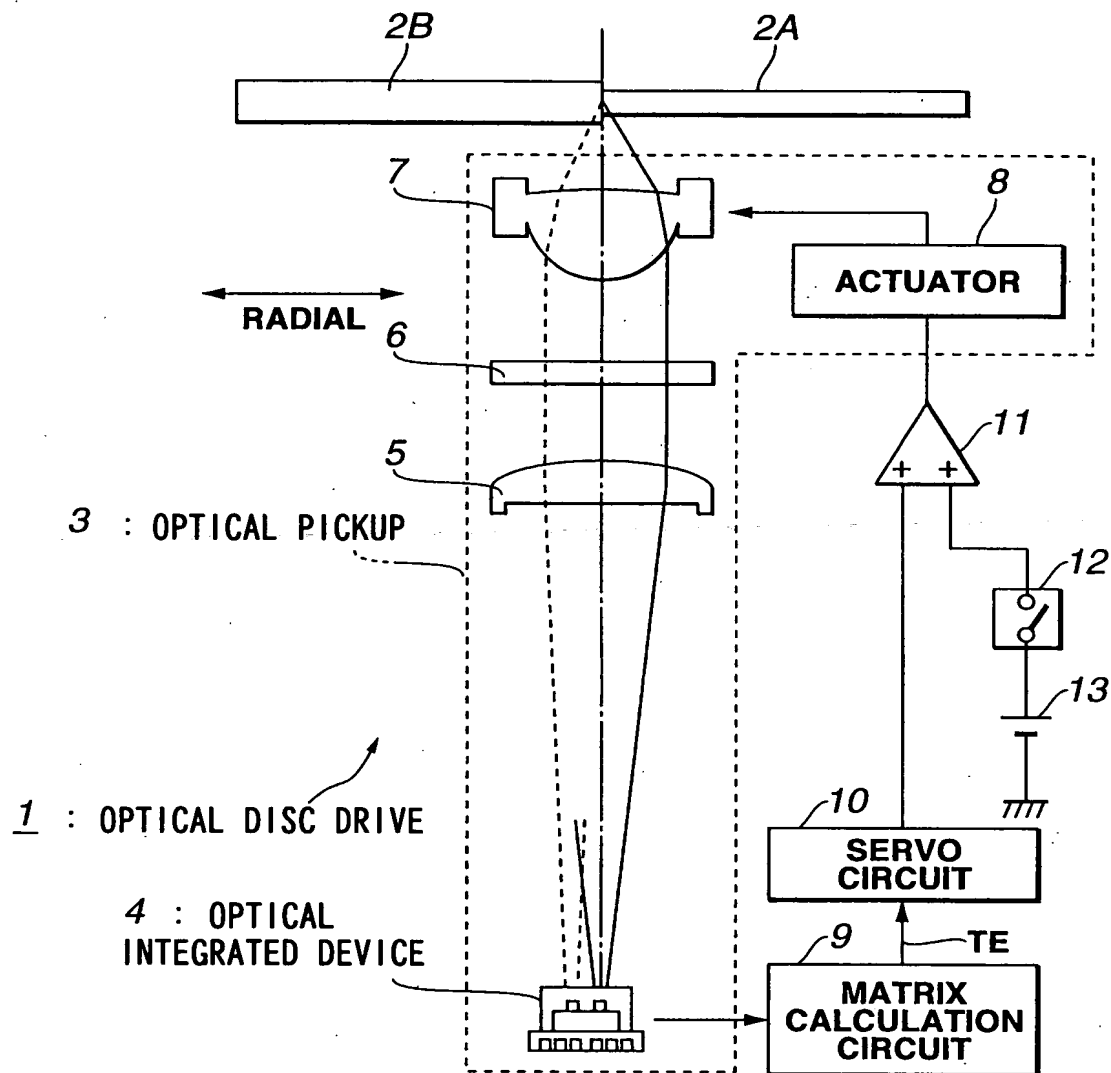
FIG. 4 is a plan view, enlarged in scale, of the light-incident surfaces of the optical integrated device in FIG. 3; and

FIG. 5 is a schematic diagram explaining how to process results of light detection by the light-incident surfaces shown in FIG. 4.

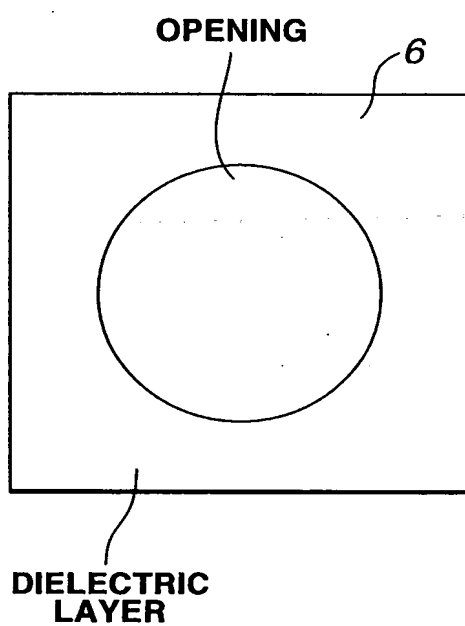
[Explanation of Referenced Numerals]

1 ... Optical disc drive, 2A ... DVD, 2B ... CD, 3 ... Optical pickup, 4 ... Optical integrated device, 5 ... Collimator lens, 7 ... Objective lens, 8 ... Actuator, 10 ... Servo circuit, 13 ... Power source

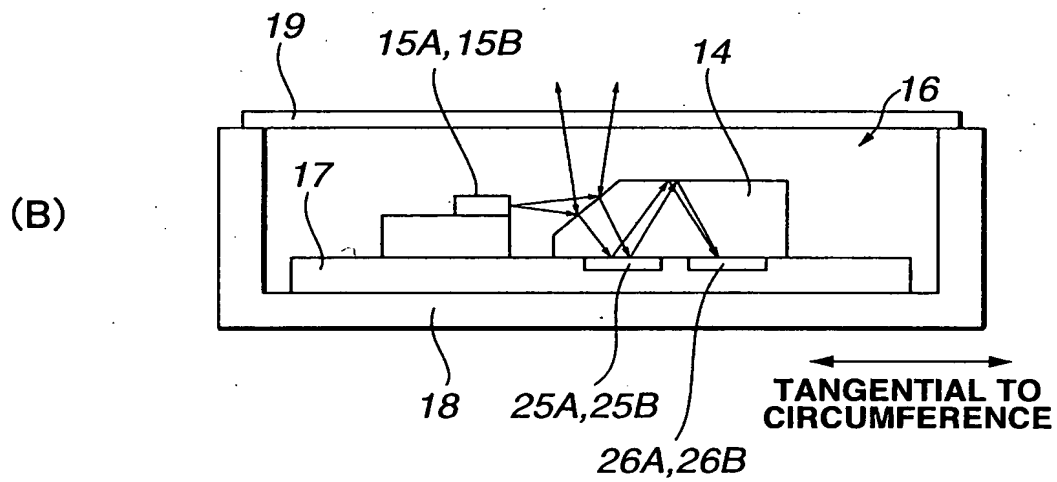
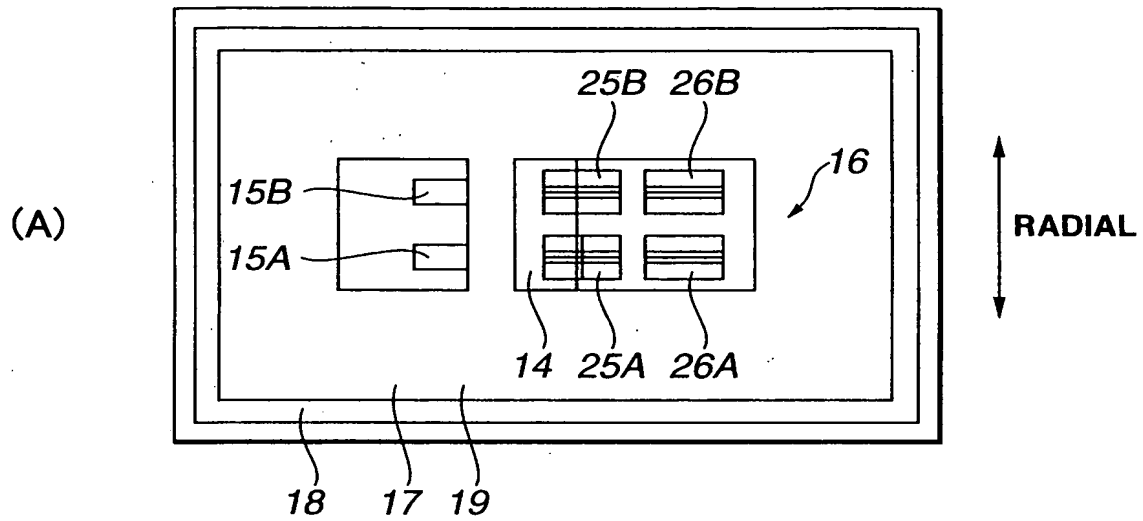
[DOCUMENT NAME] DRAWING
[FIG.1]



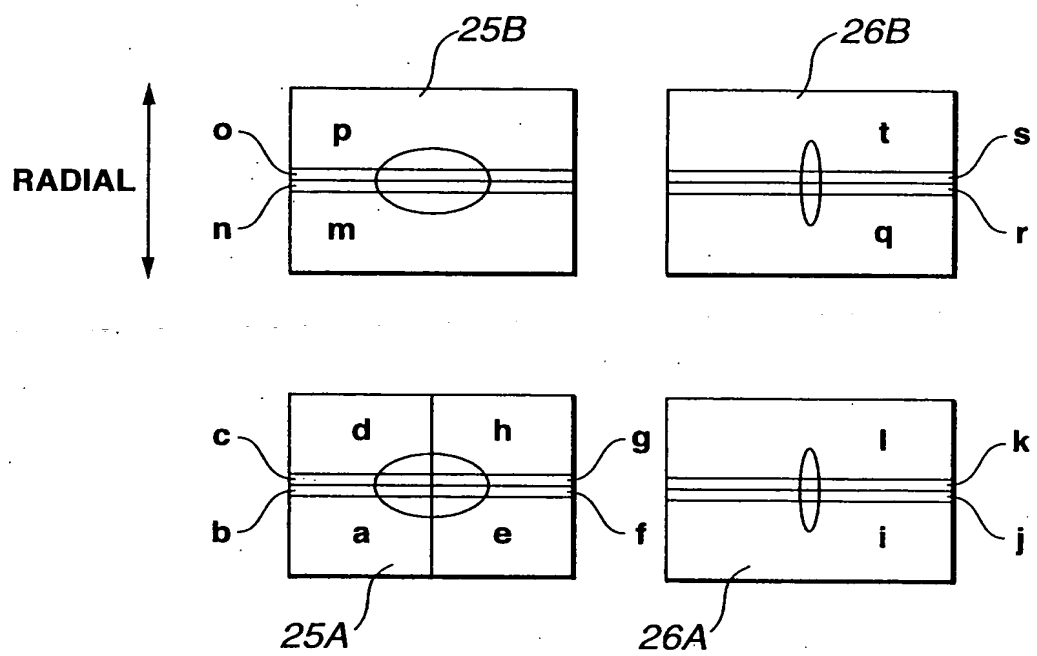
[FIG.2]



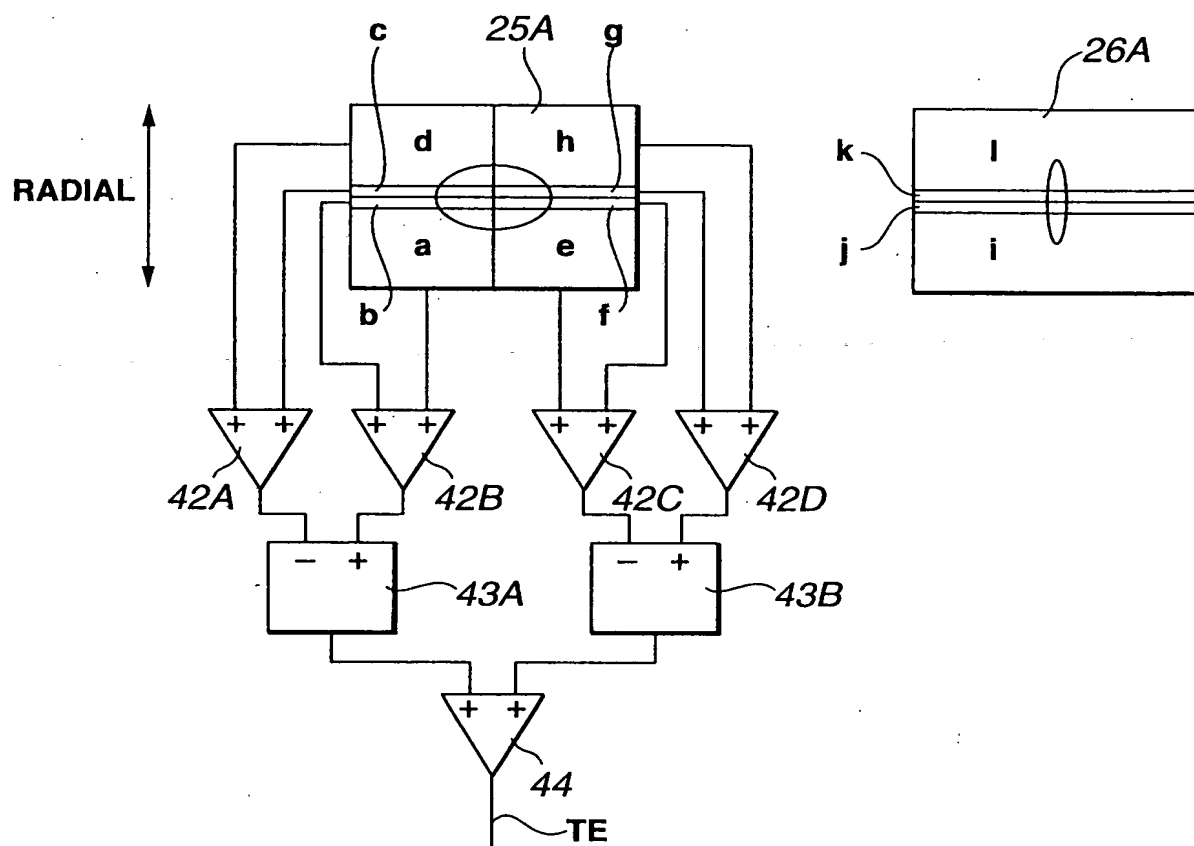
[FIG.3]



[FIG.4]



[FIG.5]



[Name of Document] ABSTRACT

[Summary]

[Task]

The present invention relates to an optical disc drive. It is applied to an optical disc drive compatible with optical discs of different types, for example, a compact disc and DVD. Using a single optical pickup in common with such optical discs of different types, the optical disc drive can make information write or read to or from the optical discs without deterioration of the optical property.

[Means for Solution]

A laser beam is emitted from a selected one of a plurality of light sources disposed apart from each other radially of optical discs (2A, 2B), and focused on either of the optical discs (2A, 2B) by moving a component (7) of a common optical system (5, 6, 7) radially of the optical disc (2A, 2B) correspondingly to the selection of the light source for emitting the laser beam.

[Selected Drawing] FIG. 1